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The Potential of CO_2 Torrefaction as Biomass Pre-Treatment Method

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Abstract

Background/Objectives: The aim of this study is to evaluate the effect of carbon dioxide (CO_2) for potentially improving the torrefaction of the empty fruit bunch (EFB), whereby conventional torrefaction is usually performed in an inert environment. **Methods/Statistical Analysis**: The experiment was carried out in a vertical tubular reactor, for various CO_2 concentrations (0%, 10%, 15% and 21%) at two (2) different temperatures; 240°C representing the mild torrefaction and at 280°C representing the severe torrefaction condition. Additionally, the impact of torrefaction was also evaluated at 15 and 30 minutes. **Findings**: It was observed that the appearance of the torrefied EFB tends be darker at the severe torrefaction temperature due to carbonization. The mass yield emits distinctive trends, whereby at 30 minutes residence time, the mass yield was decreased to less than 30% of the initial weight as the concentration of CO_2 was increased. The moisture content was improved from 7.22% down to 4.92% at the mild torrefaction while similar trend was observed for the severe torrefaction condition, as the concentration of CO_2 was increased. **Application/Improvements**: This suggest the potential of utilizing CO_2 in the torrefaction process is beneficial and should be explored further to improve the properties of biomass for energy application.

Keywords: Biomass Pre-Treatment, Carbon dioxide, Oxidative Torrefaction, Torrefaction